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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/801,571	03/17/2004	Aelan Mosden	247563US6YA	2738

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EXAMINER	
DUDA, KATHLEEN	
ART UNIT	PAPER NUMBER
1756	

DATE MAILED: 09/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/801,571	MOSDEN ET AL.	
	Examiner	Art Unit	
	Kathleen Duda	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 June 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2,4-9 and 21-32* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,4-9 and 21-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1, 2, 4-9 and 21-32 are pending in this application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 2 and 4-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sachdev (US 4,493,855).

A blanket layer of an organic polymer 6 (thin film) is deposited over substrate 1. A blanket layer of a plasma polymerized organosilicon film 7 (hard mask) is deposited, followed by a layer of a photo, x-ray or e-beam resist 8 (light-sensitive). The resist is exposed and developed and then used as a mask for etching of the plasma polymerized layer 7. The resist layer 8 can be removed during the etching of the polymer layer 6 in oxygen. The plasma polymerized organosilicon layer 7 is treated in an oxygen plasma, such as a conventional oxygen plasma resist asher. The oxygen plasma converts the surface and adjacent surface of the film into an etching barrier. See col.5, 15-31 and col.6, 10-col.7, 53. The reference teaches that the

oxygen plasma coverts the surface and adjacent surface of the (patterned) organosilicon layer 7 into an etching barrier but is silent on the depth and does not disclose altering the surface layer to a depth of at least 10 angstroms. However it is known by those of ordinary skill in the art that the amount of conversion of the surface would be dependent on the conditions in which the layer was exposed to the oxygen plasma, including exposure time, temperature and oxygen concentration, thereby establishing the altered surface depth as a result effective variable. It would within the ordinary skill of one in the art to determine the optimal altered surface depth by routine experimentation and have a depth of at least 10 angstroms, if required, because the depth is a result-effective variable dependent on the conditions of oxygen plasma exposure and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch*, (617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

4. Claims 1 and 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stojakovic (US 2005/0051820).

A stack of initial layers including a photoresist, ARC layer, hard mask and MTJ stack (thin film) is formed on an underlying layer. The hard mask is etched to form a pattern and the photoresist and ARC layers are stripped using a resist strip plasma including oxygen. As the surface of the hard

mask is exposed to plasma it undergoes plasma oxidation. If needed the over etch time of the resist strip plasma may be extended to provide a thicker surface oxide. After forming the surface oxide 80 on the hard mask layer the MTJ stack 29 is etched. See also [0038]-[0042]. Table 1 discloses an etch time of 120 seconds for the resist strip and hard mask plasma oxidation. The reference teaches that a surface oxide is formed on the hard mask prior to its use as an etching mask but is silent on the depth and does not disclose altering the surface layer to a depth of at least 10 angstroms. The reference however does teach that the over etch time of the resist strip plasma may be extended if a thicker oxide surface is required, thereby establishing the altered surface depth as a result effective variable. It would within the ordinary skill of one in the art to determine the optimal altered surface depth by routine experimentation and have a depth of at least 10 angstroms, if required, because the depth is a result-effective variable dependent on the conditions of oxygen plasma exposure such as exposure time and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch*, (617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

5. Claims 1 and 3-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Angelopoulos (US 6,316,167) in view of Masuyama (US 5,114,529).

A RCHX film is deposited over an oxide layer (thin film). R is selected from the group consisting of Si, Gem B, Sn, Fe Ti and combination thereof and X is not present or selected from the group of one or more of O, N, S and F. The RCHX layers are useful as hardmask, antireflection layers. The photoresist patterns are transferred into the RCHX film, after which the photoresist is ashed. The RCHX feature is transferred into the oxide layer. See abstract, col.14, 11-17. Angelopoulos is silent on conditions used to ash the photoresist layer. Masuyama teaches that photoresist ashing is typically performed by utilizing an oxygen plasma (col.1, 16-17). It would have been obvious to one of ordinary skill in the art that the ashing of the photoresist in the method of Angelopoulous was performed using an oxygen plasma because Masuyama teaches that photoresist ashing is typically performed by utilizing an oxygen plasma. While references do not explicitly disclose that the surface of the RCHX is treated in the oxygen plasma, one of ordinary skill in the art would have to expect the RCHX surface was exposed to the oxygen plasma and therefore modified as patterned portions the RCHX surface were exposed to an oxygen plasma during the photoresist ashing. The reference does not disclose altering the surface layer to a depth of at

least 10 angstroms. However it is known by those of ordinary skill in the art that the amount of conversion of the surface would be dependent on the conditions in which the layer was exposed to the oxygen plasma, including exposure time, temperature and oxygen concentration, thereby establishing the altered surface depth as a result effective variable. It would within the ordinary skill of one in the art to determine the optimal altered surface depth by routine experimentation and have a depth of at least 10 angstroms, if required, because the depth is a result-effective variable dependent on the conditions of oxygen plasma exposure and the discovery of an optimum value of a result effective variable is ordinary within the skill of the art, as taught by *In re Boesch*, (617 F.2d 272, 205 USPQ 215 (CCPA 1980)).

6. Claims 21-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Stojakovic as applied to claims 1 and 7-9 above, and further in view of Vyvoda (US 2003/0022526).

The teachings of Stojakovic have been discussed above. Stojakovic teaches forming an oxidized hard mask surface during the photoresist strip and that the over etch time of the resist strip process can be modified depending on the endpoint thickness of the oxide desired. The reference discloses an etch time of 120 seconds for the resist strip and hard mask plasma oxidation. The reference is silent on the temperature for the plasma

oxidation and does not disclose a substrate temperature of approximately 20-400 C. Vyvoda teaches that plasma oxidation processes are typically carried out at temperatures below about 600 C [0005]. It would have been obvious to one of ordinary skill in the art to use a substrate temperature below 600 C because Vyvoda teaches that this is a typical temperature for a plasma oxidation.

Response to Arguments

7. In regards to the 103 rejection over Sachdev, Applicant argues that Sachdev does not teach an anti-reflective layer. Sachdev teaches that the hardmask material is an organosilicon which meets the limitations of the claims. This material would inherently function as an anti-reflective material.

In regards to the 103 rejection over Stojakovic, Applicant argues that Stojakovic does not teach an anti-reflective layer. Stojakovic teaches the hardmask comprising TaN/Ti/TiN which meets the limitations of the claims. Applicant argues that an oxygen plasma is not taught. Claims 4, 5 and 6 have been removed from the rejection for that reason.

In regards to the 103 rejection over Angelopoulos in view of Masuyama, Applicant argues that neither reference intentionally treats the layer with an oxygen plasma. Masuyama has been cited for its teaching of

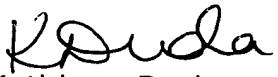
the oxygen plasma treatment. The RCHX surface is modified whether intentional or not and the surface can be any surface of the layer (i.e., it does not have to be just the top surface of the layer).

Conclusion

8. Any inquiry concerning this communication should be directed to Examiner K. Duda at (571) 272-1383. Official FAX communications should be sent to (571) 273-8300.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff, can be reached at 571-272-1385.

Information regarding the status of an application may be obtained from the Patent Application Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Kathleen Duda
Primary Examiner
Art Unit 1756